Advanced Topics in Macro-Finance*

Institute of New Structural Economics, Peking University
Junjie Xia, Spring 2021

Administration Information

Instructor: *Junjie XIA*
Office Hours: TBD (four hours a week), by appointment (email)
Office Location: Oversea Exchange Center, Room 423N
Contact: junjiexia@nsd.pku.edu.cn; www.junjiexia.com
Teaching Assistant: TBD

Course Description

- **Audience and prerequisite**

This course is designed to graduate students who have finished first-year graduate courses, including macroeconomics, microeconomics and econometrics. Although it is not required, having knowledge on advanced numerical methods and applied econometric skills is highly encouraged.

- **Course Objectives**

The primary goal of this course is to teach students advanced models and tools in Macro-Finance topics.

Finance plays a crucial role in the modern economy. In terms of financial institutions, banks and stock markets channel funds from savers towards borrowers – productive ventures, while managing economic risks and liquidity. In terms of household finance, portfolio choices affect household investment, saving and consumption decisions, which also have the aggregate impact on inequality and social mobility. Standard macro-finance theories study the link between asset prices and economic fluctuation, and models are constructed to understand simple facts in real world. Students are expected to learn different classes of models in this course. Detailed layouts are discussed in the course outline section.

- **Course Plan**

This course can be structured into four parts: a) empirical methods in finance; b) theories in macro-finance; c) calibration and structural estimation; d) other research topics and related articles. Overall, for a graduate student who chooses financial economics as his or her research field, two to three classes are expected to assign in order to cover most contents of macro-finance. Nevertheless, depending on students'

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background, I will have corresponding emphases in different parts of this course. My current plan is to fucus mostly on PART I – Empirical Methods in Corporate Finance.

For research on applied macroeconomics and empirical macro-finance, the following five steps are widely adopted.

1) Identify an idea or a question that you are interested in
2) Extract the idea from data and highlight the motivations (stylized facts)
3) Build a theoretical framework or model in the manner that is consistent with your findings in step 2). The model may have the following components.
    a) Characterize the property
    b) Provide numerical solution
4) Parameterizations and simulation (empirical): calibration/structural estimation
5) Model implications: counterfactual exercise
   (*Step 4) and step 5) could be also integrated together.*)

Step 1) depends largely on your personal interests and may not be taught in the class.

Step 2) plays an extremely important role on the paper, because the construction of your model would depend highly upon the empirical findings. Thus, this course will start from teaching students with a toolbox and working knowledge of cross-sectional and panel data empirical methods for use particularly in finance. Since modern macro-finance research relies heavily on micro-foundation, therefore, we focus mainly on the subject of corporate finance. More specifically, you will learn empirical methods combined with academic articles in Finance. Nevertheless, these methods can be also applied to other economic fields. **[This is related to PART I – Empirical Methods in Corporate Finance]**

Step 3) is the core of the paper. Macro structural models employ theory to make the linkage between outcomes and welfare, and provides a coherent framework through which to understand, interpret, and evaluate empirical evidence. This course will sketch a detailed review for various theories in Macro-Finance. We will start from the first-generation models (e.g., Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997), which have focused on financial accelerators in the representative firm environment. These types of models introduce some of the most common approaches in financial frictions, in which we will consider two – information asymmetries and collateral/enforcement constraints. Then, we will move to the second-generation models (e.g., Jermann and Quadrini, 2012; Brunnermeier and Sannikov, 2014). Most of these models are highly non-linear in formalizing financial friction, which for example allows models to generate asymmetries with significant effects on macroeconomic dynamics. Thus, we need to use some advanced computational techniques. Although I will not particularly discuss numerical methods in this course,

such as projection methods and perturbation methods, students should be aware that most modern models used in macroeconomics are highly complex and do not have a closed form solution†. Therefore, we need to find approximate solutions, and you may need to learn numerical methods in a quantitative course or by yourselves. I will provide some references in class. **[This is related to PART II – Theories in Macro-Finance]**

Step 4) and step 5) attempt to link the model directly to data. There are two general approaches – calibration and structural estimation. As far as macroeconomic models are concerned, calibration has been the most common approach used in the literature. The main goal of calibration is to ascertain that a model with a numerical solution provides predictions in the manner that is likely to be empirically relevant. In sum, calibration advances the understanding of extant empirical results by running regressions on simulated data.

Most recently, however, structural estimation has become more popular. The main purpose of structural estimation is to ensure whether optimization models are able to generate data that resemble data from the real world. Structural estimation is a useful exercise in employing a realistic theoretical structure to explicitly interpret the data. Technically, calibration aims to match a few stylized facts with many model parameters, and is useful in situations that model estimation is not feasible. However, whenever there are too many degrees of freedom, inference is impossible, and thus, calibration is not accompanied by standard errors for the model parameters. In contrast, structural estimation is able to provide standard errors. Estimation methods, like simulated method of moments (SMM), matches at least as many stylized facts as model parameters. I will discuss both methods through reviewing journal articles and will particularly emphasize on structural estimation that is commonly use in both corporate finance and macro research. **[This is related to PART III – Calibration and Structural Estimation]**

PART IV provides references on recent research topics. Students are able to find papers that make contributions to different subjects.

Textbooks

There is *NO* required textbook, but the following references could be helpful.

- *"Recursive Macroeconomic Theory"*, by Ljunqvist L., and Sargent T., MIT Press
- "Methods for Applied Macroeconomic Research", Fabio Canova, Princeton University Press

† The more dynamics, heterogeneity, frictions that models incorporate, the more challenging to solve and estimate. However, computational results are commonly criticized to disconnect from micro empirical research and to be eventually black box predictions. Therefore, the macro-micro synthesis needs to further develop.

- "Numerical Methods in Economics", Kenneth L. Judd, MIT Press
- "Dynamic General Equilibrium Modeling", Heer, B. and Maussner A, Springer
- "Structural Macroeconometrics", David De Jong and Chetan Dave, Princeton University Press
- "Frontiers of Business Cycle Research", Cooley, T. F., Princeton University Press
- "Time Series Analysis", Hamilton, J.D., Princeton University Press
- "Econometric Analysis of Cross-Section and Panel Data", Jeffrey M. Wooldridge, MIT Press.
- "Handbook of Macroeconomics", Volume 2 (2016), Taylor J. B. and Uhlig H.

Course Policy

- **Grading**

Class participation	10%
Problem sets	20%
Paper presentation	30%
Referee report	10%
Research project	30%

- **Class participation**

The class participation includes two parts: attendance and discussion. Students are expected to attend all classes at their scheduled time, and are responsible for all assigned materials. I will randomly check the class attendance. Two absences are equal to 1% deduction of total grade. Medical or other extenuating excuses are granted upon valid documentary proofs.

In addition, students are also encouraged to participate the class actively, such as in-class discussions and presentations. You could also ask any questions if something is confusing during the lectures. I do not anticipate that everything I teach in class or in-class writing will be crystal clear. I also cannot guarantee to always have an immediate answer to your questions, especially for them of a more technical nature. Therefore, your participation is very useful and helpful for your learning and my teaching.

- **Problem sets**

Each student has five assignments. The best four scores are counted into your grade (5% per each assignment). Students must turn in all five assignments. Missing one submission will deduct 5% from total grade.

- **Paper presentation and referee report**

Each student is required to provide an individual in-class paper presentation and submit a referee report for the same paper. Students may choose a journal article or a

working paper in the related literature. The presentation is 40 minutes, including 10 minutes Q and A.

Presenting is an important skill for academic research. A successful presentation may cover concisely the following five points: a) what is the motivation; b) what does the paper do; c) what are the results/findings; d) overall contributions; e) your comments and criticisms of the paper.

The referee report is no more than three pages. Each student is required to read a paper critically and write down the virtues and limitations of this paper.

- **Research project**

Each student has a research project. You are expected to turn in a short research proposal (no more than 5 pages) and give a 15-minute presentation. A successful paper is considered to be modestly, rather than overly ambitious. You can identify a question that you are interested in. The topic could be one that has been tackled to some extent already in the literature and add to its existing treatment. Even small or incremental progress over existing work is a contribution.

Course Outline

(*Note: the allocation of lectures in each part may be subject to change*)

PART I: Empirical Methods in Corporate Finance

i. Linear regression, causality and panel data:

Lecture notes will be given and references are as follows

- "The Stock Market and Investment: Is the Market a Sideshow?" Randal Morck, Andrei Shleifer and Robert Vishny (1990), *Brooking Papers on Economic Activity*, 157–215.
- "Financial dependence and growth," Raghuram G. Rajan and Luigi Zingales (1998), *American Economic Review*, 88(3), 559-586.
- "The determinants and implications of corporate cash holdings," Timothy Opler, Larry Pinkowitz, Rene Stulz and Rohan Williamson (1999), *Journal of Financial Economics* 52, 3-46.
- "Using Maimonides' rule to estimate the effect of class size on scholastic achievement," Joshua D. Angrist, and Victor Lavy (1999), *Quarterly Journal of Economics*, 533-575.
- "Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market," Asim I. Khwaja and Atif Mian (2008), *American Economic Review*, 98(4), 1413-1442.

- "Capital structure as a strategic variable: Evidence from collective bargaining," David A. Matsa (2010), *Journal of Finance*, 65(3), 1197-1232.
- "Local dividend clienteles," Bo Becker, Zoran Ivkovic and Scott Weisbenner (2011), *Journal of Finance*, 66(2), 655-683.
- "Labor unemployment risk and corporate financing decision," Ashwini Agarwal and David A. Matsa (2013), *Journal of Financial Economics*, 108(2), pp. 449-470.
- "Dissecting the effect of credit supply on trade: Evidence from matched credit-export data," Paravisini, Daniel, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon (2014), *Review of Economic Studies*, 1-26.

ii. Problems of panel regressions and some potential solutions

a) Instrumental variables

Lecture notes will be given and references are as follows

- "The colonial origins of comparative development: An empirical investigation," Daron Acemoglu, Simon Johnson, and James A. Robinson (2001), *American Economic Review* 91(5), 1369-1401.
- "Inside the family firm: The role of families in succession decisions and performance," M. Bennedsen, K Nielsen, F. Perez-Gonzalez, and D. Wolfenzon (2007), *Quarterly Journal of Economics*, 122, 647-691.
- "Costly external finance, corporate investment, and the subprime mortgage credit crisis," Ran Duchin, Oguzhan Ozbas and Berk A. Sensoy (2010), *Journal of Financial Economics*, 97, 418-435.
- "Snow and leverage," Xavier Giroud, Holger M. Mueller, Alex Stomper and Arne Westerkamp (2012), *Review of Financial Studies*, 25, 680-710.

b) Natural experiments

Lecture notes will be given and references are as follows

- "Enjoying the quiet life? Corporate governance and managerial preferences," Marianne Bertrand and Sendhil Mullainathan (2003), *Journal of Political Economy*, 111(5), 1043-75.
- "How much should we trust difference-in-difference estimates? Marianne Bertrand, Esther Duflo, and Sendhil Mullainathan (2004), *Quarterly Journal of Economics* 119:249–75.
- "Growing Out of Trouble? Corporate Responses to Liability Risk," Todd A. Gormley and David Matsa (2011), *Review of Financial Studies*, 24(8), 2781-2821.
- "Stock options and managerial incentives for risk taking: evidence from FAS 123R," Hayes, Rachel M., Michael Lemmon, and Mingming Qiu (2012), *Journal of Financial Economics*, 105, 174-190.
- "Fiduciary Duties and Equity-Debtholder Conflicts," Becker, Bo, and Per Stromberg (2012), *Review of Financial Studies* 25(6), 1931-1969.

- "The impact of investor protection law on corporate policy and performance: evidence from the blue sky laws," Ashwini Agrawal (2013), *Journal of Financial Economics*, 107, 417-35.
- "A practitioner's guide to cluster-robust inference," Cameron Colin and Douglas Miller (2015), *Journal of Human Resources*, 50(2): 317-372
- "The Impacts of Political Uncertainty on Asset Prices: Evidence from the Bo Scandal in China" L. Liu, H. Shu and K. C. Wei (2017), *Journal of Financial Economics*, 125
- "Creditor rights and innovation: Evidence form patent collateral" William Mann (2018), *Journal of Financial Economics*, 130, 25-47.
- "Political Uncertainty and Managerial Preferences: Evidence from Discipline Inspections in China" K. Wang and J. Xia (2021), working paper

c) Regression Discontinuity

Lecture notes will be given and references are as follows

- Did securitization lead to lax screening? Evidence from subprime loans, Keys, Benjamin, Ranmoy Mukherjee, Amit Seru, and Vikrant Vig (2010), *Quarterly Journal of Economics* 125, 307-362.
- "The role of proxy advisory firms: Evidence from a regression-discontinuity design," Nadya Malenko and Yao Shen (2015), *Review of Financial Studies*, 29(12), 3394-3427.
- "The Real Effects of Share Repurchases," Almeida, Heitor, Vyacheslav Fos, and Mathias Kronlund (2016), *Journal of Financial Economics*, 119, 168-185.
- "Government Credit, a Double-Edged Sword: Evidence from the China Development Bank", Hong Ru (2018), *Journal of Finance* 73(1): 275-316

d) Common limitations and errors; standard errors and clustering limited dependent variables; matching and selection models

Lecture notes will be given and references are as follows

- "Rewriting history," Alexander Ljungqvist, Christopher Malloy and Felicia Marston (2009), *Journal of Finance*, 64(4), 1935-1960.
- "Playing it Safe? Managerial Preferences, Risk, and Agency Conflicts," Todd A. Gormley and David A. Matsa (2016), *Journal of Financial Economics*, 122, 431-455.
- "Spin-offs, divestitures, and conglomerate investment," Gonul Colak and Toni Whited (2007), *Review of Financial Studies* 20, 557-595.
- "Payday lenders: heroes or villains?" Adair Morse (2011), *Journal of Financial Economics*, 102, 28-44.
- "Information disclosure, cognitive biases, and payday lending," Marianne Bertrand and Adair Morse (2011), *Journal of Finance* 66(6), 1865-1893.

- "Incentivizing calculated risk- taking: Evidence from an experiment with commercial bank loan officers," Shawn Cole, Martin Kanz, and Leora Klapper (2015), *Journal of Finance* 70(2), 537-575.

PART II: Theories in Macro-Finance

The advantage of developing macro models is to help researchers investigate clearly and quantitatively the roles of aggregate resources constraints, forward-looking/dynamics, various obstacles to allocate resources, scale economies, general equilibrium effects, and their implications to aggregate distributions and welfare.

i. Preliminary review

a) Dynamic programming, some key general equilibrium notions and two workhorse models: Lucas tree and RBC

Lecture notes will be given and references are as follows

- "*Recursive Macroeconomic Theory*", Chapters 3, 4, 8, 12, 13

b) Numerical approximation

Lecture notes will be given and references are as follows

- "*Dynamic General Equilibrium*", Heer, B. and Maussner, A (2009), Chapters 2, 6
- Lecture notes (in-class handouts)

ii. Core models on financial frictions

a) Introduction: modeling financial frictions

1) Missing markets: exogenous market incompleteness; endogenous market incompleteness (limited enforcement and information asymmetry)

2) Heterogeneity: finite life span; different discounting; tax benefits; bargaining position

Lecture notes will be given and references are as follows

- "Financial frictions in Macroeconomic Fluctuations", Quadrini, Vincenzo, (2011), *Federal Reserve Bank of Richmond Economic Quarterly*, 97 (3), pp 209-254
- Lecture notes (in-class handouts)

b) First-generation models

We will consider some of the most common approaches that can be used to introduce financial frictions in macroeconomic models. We will look at two approaches – information asymmetries and collateral or enforcement constrains. The following papers in the earlier literature have focused on financial accelerators in representative firm environment. Particularly, we will go over two seminal articles: Bernanke and Gertler (1989) and Kiyotaki and Moore (1997). In addition, we will

learn a simplified two-period exposition of Gertler-Kiyotaki (2015) model.
Lecture notes will be given and references are as follows

- "Agency Costs, Net Worth, and Business Fluctuations", Bernanke, B. and Gertler, M. (1989), *American Economic Review*, 79(1), pp. 14-31
- "Credit Cycles", Kiyotaki, N. and Moore, J.H. (1997), *Journal of Political Economy*, 105(2), pp. 211-48.
- "The Financial Accelerator in a Quantitative Business Cycle Framework", Bernanke, B., Gertler, M., Gilchrist, S. (1999), *Handbook of Macroeconomics*, North Holland, Volume 1C, Chapter 21, pp. 1341-96
- "Banking, Liquidity, and Bank Runs in an Infinite Horizon Economy", Gertler, M. and N. Kiyotaki (2015), *American Economic Review*, 79(1), pp. 14-31

c) Second-generation models

The second-generation models are extensions of early models.
Lecture notes will be given and references are as follows

- "Macroeconomic Effects of Financial Shocks", Jermann, U. and Quadrini, V. (2012), *American Economic Review*, 102(1), pp. 238-271
- "Finance and Misallocation: Evidence from Plant-Level Data", Midrigan, V. and Xu Y. (2014), *American Economic Review*, 104(2), pp. 422-58
- "A Macroeconomic Model with a Financial Sector", Brunnermeier, M.K., and Sannikov Y. (2014), *American Economic Review*, 104(2), pp. 379-421

d) Introducing heterogeneity

We start from two types of heterogeneity: one is overlapping generation and one is heterogeneity that is asset holdings when agents face uninsurable idiosyncratic risks. Then, we discuss a broad range of preferences and market structures, such as Habits (e.g., Campell and Cochrane 1999), idiosyncratic risk (e.g., Constantinides and Duffie, 1996), heterogeneous preferences (Garleanu and Panageas, 2015) and ambiguity aversion (Hansen and Sargent, 2001).
References

- "*Recursive Macroeconomic Theory*", Chapters 9, 16, 17
- Lecture notes on the inequality of China
- "Cost of Business Cycles With Indivisibilities and Liquidity Constraints", Imrohoroglu, A. (1989), *Journal of Political Economy*, 97(6), pp. 1364-83.
- "Uninsured Idiosyncratic Risk and Aggregate Saving", Aiyagari, S. R. (1994), *Quarterly Journal of Economics*, CIX(3), pp. 659-84
- "Income and Wealth Heterogeneity in the Macroeconomy", Krusell, P. and Smith, A. A. (1998), *Journal of Political Economy*, 106(5), pp. 867-896.

PART III: Calibration and Structural Estimation

As discussed in the first part, there are some distinctions between calibration and structural estimation. I will briefly introduce calibration by discussing some articles and focus on structural estimation.

Structural estimation attempts to fit a model directly to data; to assess the quality of the model; and to identify parameters governing preferences, technologies and time-invariant institutional features. More specifically, structural estimation evaluates whether optimization models are able to generate data that resemble data from the real world. Therefore, structural estimation is employing a realistic theoretical structure to interpret the data. (*Please note that structural estimation may or may not require a dynamic model*)

There are three main methods that have been widely used in Macro-Finance for structural estimation: generalized method of moments (GMM); simulated method of moments (SMM); and simulated maximum likelihood (SMLE). This course will particularly provide a brief introduction to SMM.

i) Some tools

Lecture notes will be given and references are as follows

- "*Methods for Applied Macroeconomic Research*", Canova F. (2007), Chapters 3, 4, 7, 9, 11
- "Bayesian Analysis of DSGE Models", An, S. and Schorfheide, F. (2007), *Econometric Reviews*, 26(2-4), 113-72
- "Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series: Implications for Business Cycle Research", Timothy Cogley and James Nason (1995) *Journal of Economic and Dynamic Control* (Univariate time series)
- "Monetary policy shocks: What have we learned and to what end?" Lawrence J. Christiano, Martin Eichenbaum and Charles L. Evans (1999), In Handbook of Macroeconomics, pp. 65-148. (Vector autoregressions)
- Measuring the effects of monetary policy: A factor-augmented vector autoregressive (FAVAR) approach (2005), Ben Bernanke, Jean Boivin, and Piotr Eliasz, Quarterly Journal of Economics, 120(1), 387-422 (Kalman Filter and dynamic factor models)

ii) Continuous time contingent claims models

- "Temporary versus permanent shocks: Explaining corporate financial policies", Alexander S. Gorbenko and Ilya A. Strebulaev, 2010, *Review of Financial Studies 23*, 2591–2647.

iii) Discrete time investment models

- "Financing investment", Joao F. Gomes, 2001, *American Economic Review,* 91, 1263–1285.
- "How costly is external financing? Evidence from a structural estimation", Christopher A. Hennessy, and Toni M. Whited, 2007, Journal of Finance, 62, 1705–1745.
- "The corporate propensity to save", Leigh A. Riddick and Toni M. Whited, 2009, *Journal of Finance,* 64, 1729–1766.
- "Capital structure dynamics and transitory debt", Harry DeAngelo, Linda DeAngelo, and Toni M. Whited, 2011, *Journal of Financial Economics,* 99, 235–261.
- "Macroeconomic Effects of Financial Shocks", Urban Jermann and Vincenzo Quadrini, 2012, *American Economic Review*, 102(1), pp. 238-271

PART IV: Other Recent Research Topics and Related Articles

a) Macroeconomic models with financial imperfections

Macro models with financial frictions *(further readings)*

- "Agency Costs, Net Worth and Business Fluctuations: A Computable General Equilibrium Approach", Carlstrom, C. and Fuerst, T., *American Economic Review*, 1997
- "Endogenous Liquidity and the Business Cycle", Bigio, S., *American Economic Review*, 2015
- "Uncertainty Shocks and Balance Sheet Recessions", Di Tella, *American Economic Review*, 2015
- "Optimal Development Policies with Financial Frictions", O. Itskhoki and B. Moll, *Econometrica*, 2019

Quantifying Financial Frictions

- "Accounting for Business Cycles", Chari, V., Kehoe, P. and McGrattan, E., *Econometrica,* 2007
- "Quantifying the Forces Leading to the Collapse of GDP after the Financial Crisis", R. E. Hall, *NBER Macroeconomics Annual,* 2014
- "Has the U.S. Finance Industry Become Less Efficient?" T. Philippon, *American Economic Review*, 2015

Models with Heterogeneous Firms

- "Credit Shocks and Aggregate Fluctuations in an Economy with Production Heterogeneity", Khan, A., and Thomas, J.K., *Journal of Political Economy*, 2014
- "Aggregate Implications of Corporate Debt Choices", Crouzet, N., *Review of Economic Studies*, 2017

Bubbles

- "Asset Bubbles, Collateral, and Policy Analysis", J. Zhou, J. Miao and P. Wang, *Journal of Monetary Economics*, 2015
- "Asset Bubbles and Credit Constraints", Jianjun Miao and Pengfei Wang, *American Economic Review*, 2018

Monetary Policy

- "Banking and Interest Rates in Monetary Policy: A Quantitative Exploration", M. Goodfriend and B. T. McCallum, *Journal of Monetary Economics*, 2008
- "A Model of Unconventional Monetary Polity", M. Gertler and P. Karadi, *Journal of Monetary Economics*, 2011
- "Dynamics of Trade Credit in China", W. Cun, V. Quadrini, Q. Sun and J. Xia, Working Paper (R&R at The Economic Journal)

b) Quantitative Models of Debt: Corporate, Household and Sovereign

Optimal Capital Structure of Firms

- "Liquidation Values and Debt Capacity: A Market Equilibrium Approach", Shleifer, A. and Vishny, R., *Journal of Finance*, 1992
- "Optimal Capital Structure, Endogenous Bankruptcy, and the Term Structure of Credit Spreads", Hayne, L. and Toft, K., *Journal of Finance*, 1996
- "Collateral and Capital Structure", Rampini, A. and Viswanathan, S., *Journal of Financial Economics*, 2013

Corporate Investment with Debt

- "How Costly is External Financing? Evidence from a Structural Estimation", Hennessy, C. and Whited T. M., *Journal of Finance*, 2007
- "Financing Intangible Capital", Q. Sun and M. X. Zhang, *Journal of Financial Economics*, 2019

Credit Spreads

- "The Risk-Adjusted Cost of Financial Distress", Almeida, H. and Philippon, T., *Journal of Finance*, 2007
- "Macroeconomic Conditions and the Puzzles of Credit Spreads and Capital Structure", Chen Hui, *Journal of Finance*, 2011
- "Endogenous Liquidity and Defaultable Bonds", He, Z. and Milbradt, K., *Econometrica*, 2013

Household and Sovereign Debt

- "A Quantitative Theory of Unsecured Consumer Credit with Risk of Default", Chatterjee, S., Corbae, D., Nakajima, and Rios Rull, V., *Econometrica*, 2006
- "Default Risk and Income Fluctuations in Emerging Economies", Arellano, C., *American Economic Review*, 2008
- "A General Equilibrium Model of Sovereign Default and Business Cycles", Mendoza, E., and Yue, V., *Quarterly Journal of Economics*, 2012

Self-fulfilling and Finance

- "Self-Fulfilling Debt Crises", Code, H. and Kehoe, T., *Review of Economic Studies*, 2000
- "Financial Markets, the Real Economy and Self-fulfilling Uncertainties", J. Benhabib, X. Liu and P. Wang, *Journal of Finance*, 2019
- "Self-fulfilling Debt Crises: A Quantitative Analysis", L. Bocola and A. Dovis, *American Economic Review*, 2019
- "Self-fulfilling Credit Market Freezes", L. A. Bebchuk and I. Goldstein, *Review of Financial Studies*, 2011

c) Quantitative Corporate Finance

Optimal investment with frictions

- "A Unified Model of Investment Under Uncertainty", Abel, A. and Eberly, J., *American Economic Review*, 1994
- "Explaining the Investment Dynamics in U.S. Manufacturing: A Generalized (S, s) Dynamics", Ricardo Caballero and Eduardo Engel, *Econometrica,* 1999
- "Dynamic Agency and the Q Theory of Investment", Demarzo, P, Fishman, M., He Z. and Wang, N., *Journal of Finance,* 2009

Industry equilibrium without investment

- "Entry, Exit, and Firm Dynamics in Long Run Equilibrium", *Econometrica*, 1992
- "Selection, Growth and the Size Distribution of Firms", Luttmer, E., *Journal of Political Economy*, 2007
- "Granular Origins of Business Cycles", Gabaix, X., *Econometrica*, 2011

Macro Investment

- "The Stock Market and Capital", Hall, R., *American Economic Review*, 2001
- "The Impact of Uncertainty Shocks", Bloom, N., *Econometrica*, 2007
- "The Bond Market's Q", Philippon, T., *Quarterly Journal of Economics*, 2009

d) Misallocation, financial frictions and production network

- "Policy Distortions and Aggregate Productivity with Heterogeneous Plants", Restuccia, D. and Rogerson R., *Review of Economic Dynamics*, 2008
- "Misallocation and manufacturing TFP in China and India", Hsieh C. and Klenow P., *Quarterly Journal of Economics,* 2009
- "Intermediate Goods and Weak Links in the Theory of Economic Development", Charles, J. I., *American Economic Journal: Macroeconomics*, 2011
- "The Network Origins of Aggregate Fluctuations", Acemoglu, D., Carvalho, V. M., Ozdaglar, A., Tahbaz-Salehi, A., *Econometrica*, 2012
- "Organizing the Global Value Chain", Antras, P. and Chor, D., *Econometrica*, 2013.
- "Misallocation, Economic Growth, and Input-Output Economics", Hugo, H. A., *Advances in Economics and Econometrics*, Tenth World Congress, Volume II, Cambridge University Press

- "Productivity Losses from Financial frictions: Can Self-financing Undo Capital Misallocation?" Ben Moll, *American Economic Review*, 2014
- "Finance and Misallocation: Evidence from Plant-Level Data", Midrigan, V. and Xu Y., *American Economic Review*, 2014
- "Industrial Policies in Production Networks", Liu, E., *Quarterly Journal of Economics*, 2020
- "Distortions in Production Networks", Bigio, S. and La'O J., *Quarterly Journal of Economics*, 2020

e) Fiscal policy, government spending and macroeconomics

- "Measuring the Output Responses to Fiscal Policy," Gorodnichenko, Y. and Auerbach A., *American Economic Journal – Economic Policy*, 2012
- "Fiscal Multiplier in Recession and Expansion", Gorodnichenko, Y. and Auerbach A., *Fiscal Policy after the Financial Crisis*, University of Chicago Press, 2012
- "Can Government Purchases Stimulate the Economy?" V.A. Ramey, *Journal of Economic Literature*, 2012
- "Government Spending Multipliers in Good Times and in Bad: Evidence from US Historical Data", Ramey, V.A. and Zubairy, S., *Journal of Political Economy*, 2018
- "Geographic Cross-Sectional Fiscal Spending Multipliers: What Have We Learned?", Gabriel Chodorow-Reich, *American Economic Journal: Economic Policy*, 2019

f) Inequality

Inequality is a large subject in macroeconomics. Topics in income inequality, consumption inequality and wealth inequality have been catching a lot of attentions. Models share many similarities with that in macro-finance, for example, the application from the Aiyagari type of models. However, this subject could be also assigned a specific course to cover empirical findings and theories. The following references are some core papers and recent studies.

- "Uninsured Idiosyncratic Risk and Aggregate Saving", Aiyagari, S. R., *Quarterly Journal of Economics*, 1994
- "Income and Wealth Heterogeneity in the Macroeconomy", Krusell, P. and Smith, A. A. , *Journal of Political Economy*, 1998
- "Entrepreneurship, Saving, and Social Mobility", Quadrini, V., *Review of Economic Dynamics*, 2000
- "Capital-Skill Complementarity and Inequality: A Macroeconomic Analysis", Krusell, P., Ohanian, L., Rios-Rull, J., and Violante, G., *Econometrica*, 2000
- "Entrepreneurship, Frictions, and Wealth", Cagetti M., and De Nardi M., *Journal of Political Economy*, 2006

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